Episode 16:
An ICONic Launch

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@NASAKennedy
#NASARocketRanch

New episodes every month!

1
00:00:05,690 --> 00:00:02,360
most of the time we launch rockets with

2
00:00:07,039 --> 00:00:05,700
the pointy end up sometimes we strap

3
00:00:09,070 --> 00:00:07,049
rockets to the belly of commercial

4
00:00:24,560 --> 00:00:09,080
airliners and drop them over the ocean

5
00:00:26,179 --> 00:00:24,570
next on the rocket ranch as we are

6
00:00:27,609 --> 00:00:26,189
recording this we're in the throes of a

7
00:00:31,099 --> 00:00:27,619
launch campaign for the ionospheric

8
00:00:32,510 --> 00:00:31,109
connection Explorer or icon we'll get

9
00:00:34,520 --> 00:00:32,520
back to the science of the mission in a

10
00:00:35,900 --> 00:00:34,530
few minutes but first we wanted to take

11
00:00:39,350 --> 00:00:35,910
some time to talk about a one-of-a-kind

12
00:00:41,240 --> 00:00:39,360
launch capability this launch is managed

13
00:00:43,299 --> 00:00:41,250

by NASA's launch services program and

14
00:00:46,220 --> 00:00:43,309
they selected the Pegasus XL rocket

15
00:00:48,229 --> 00:00:46,230
manufactured by north of Drummond here

16
00:00:49,880 --> 00:00:48,239
is Phil Joyce vice president space

17
00:00:51,100 --> 00:00:49,890
launch programs Northrop Grumman

18
00:00:53,630 --> 00:00:51,110
innovation systems

19
00:00:54,920 --> 00:00:53,640
alright I'm now in the booth with Phil

20
00:00:56,900 --> 00:00:54,930
Joyce Phil thank you so much for joining

21
00:00:58,369 --> 00:00:56,910
me today it's great to be here and we're

22
00:01:00,740 --> 00:00:58,379
glad to have Northrop in town we're glad

23
00:01:02,119 --> 00:01:00,750
to see this Pegasus ready to fly I want

24
00:01:04,250 --> 00:01:02,129
to kind of back up a little bit and

25
00:01:05,630 --> 00:01:04,260
learn more about you and kind of your

26
00:01:07,280 --> 00:01:05,640
history you've been with Pegasus for

27
00:01:09,950 --> 00:01:07,290
quite some time now yeah well I've been

28
00:01:13,010 --> 00:01:09,960
with orbital sciences now Northrop

29
00:01:15,020 --> 00:01:13,020
Grumman thus since 1992 so a 27 year

30
00:01:17,240 --> 00:01:15,030
veteran of the launch vehicle business

31
00:01:19,760 --> 00:01:17,250
with a career that spans a lot of

32
00:01:21,170 --> 00:01:19,770
different launch platforms Pegasus is

33
00:01:24,440 --> 00:01:21,180
one of the platforms in my portfolio

34
00:01:27,609 --> 00:01:24,450
today I have the small launch vehicle

35
00:01:31,280 --> 00:01:27,619
area at Northrop Pegasus is a

36
00:01:34,219 --> 00:01:31,290
world-class launch vehicle the first

37
00:01:37,039 --> 00:01:34,229
privately developed launch vehicle back

38
00:01:40,340 --> 00:01:37,049

in the day with the first flight in 1990

39
00:01:41,929 --> 00:01:40,350
um and also of course as you noted a

40
00:01:43,700 --> 00:01:41,939
very unique launch vehicle and the fact

41
00:01:45,679 --> 00:01:43,710
that it that it is air launched and it

42
00:01:48,560 --> 00:01:45,689
was the first air launch space launch

43
00:01:51,289 --> 00:01:48,570
vehicle ever constructed with the first

44
00:01:54,020 --> 00:01:51,299
flight in 1990 this will be our 44th

45
00:01:55,490 --> 00:01:54,030
Pegasus mission awesome Congrats so are

46
00:01:56,899 --> 00:01:55,500
you an engineer by trade I am I'm an

47
00:01:58,580 --> 00:01:56,909
aerospace engineer have you had any

48
00:02:00,319 --> 00:01:58,590
personal like favorite missions or

49
00:02:03,020 --> 00:02:00,329
favorite like moments in your career

50
00:02:05,810 --> 00:02:03,030
well you know it's it's hard to it's

51
00:02:07,429 --> 00:02:05,820
hard to top flying to the Sun so so when

52
00:02:09,919 --> 00:02:07,439
we did the upper stage - Parker Solar

53
00:02:12,470 --> 00:02:09,929
Probe and delivered that spacecraft just

54
00:02:13,260 --> 00:02:12,480
on the bull's eye cool that was that was

55
00:02:15,690 --> 00:02:13,270
a wonderful

56
00:02:17,790 --> 00:02:15,700
but every launch is the same it's all

57
00:02:21,060 --> 00:02:17,800
adrenaline it's all that that nerves

58
00:02:23,280 --> 00:02:21,070
just before the ignition pegasus

59
00:02:25,980 --> 00:02:23,290
missions are no different and certainly

60
00:02:28,650 --> 00:02:25,990
they they feel as intense as any of them

61
00:02:32,490 --> 00:02:28,660
cool and so I want to make sure that we

62
00:02:33,930 --> 00:02:32,500
don't overlook the air drop fact because

63
00:02:36,750 --> 00:02:33,940

that is I think that's what makes this

64
00:02:37,980 --> 00:02:36,760
the most unique so help give people that

65
00:02:39,780 --> 00:02:37,990
are listening to this kind of a visual

66
00:02:42,930 --> 00:02:39,790
for what does that mean when we say air

67
00:02:44,850 --> 00:02:42,940
drop well air drop can be done in

68
00:02:46,680 --> 00:02:44,860
different ways we we do it in a way that

69
00:02:49,560 --> 00:02:46,690
really boosts the performance of the

70
00:02:52,020 --> 00:02:49,570
system you take you take a launch

71
00:02:54,870 --> 00:02:52,030
vehicle which is a combination of

72
00:02:57,540 --> 00:02:54,880
propulsive stages with a payload on the

73
00:03:00,480 --> 00:02:57,550
front underneath the payload fairing and

74
00:03:02,460 --> 00:03:00,490
our case we take that on the l-1011 up

75
00:03:05,150 --> 00:03:02,470
to a launch condition which actually

76
00:03:08,720 --> 00:03:05,160
adds a lot of energy to the equation and

77
00:03:10,890 --> 00:03:08,730
and and that energy that the l-1011

78
00:03:13,260 --> 00:03:10,900
delivers which is an altitude of

79
00:03:15,780 --> 00:03:13,270
something like 40,000 feet and a drop

80
00:03:18,240 --> 00:03:15,790
speed of something like point eight is

81
00:03:21,270 --> 00:03:18,250
actually our first stage and it doubles

82
00:03:22,500 --> 00:03:21,280
the payload performance of of the rocket

83
00:03:25,290 --> 00:03:22,510
compared to if you launch it on the

84
00:03:28,410 --> 00:03:25,300
ground so l-1011 for our younger viewers

85
00:03:30,630 --> 00:03:28,420
who may not be familiar I think you guys

86
00:03:32,070 --> 00:03:30,640
have titled yours the l-1011 stargazer

87
00:03:33,900 --> 00:03:32,080
is that correct that's right stargazer

88
00:03:35,160 --> 00:03:33,910

so what is the l-1011 just for people

89
00:03:37,350 --> 00:03:35,170
who have never heard of it before

90
00:03:39,120 --> 00:03:37,360
so the l-1011 tristar is used to be a

91
00:03:41,420 --> 00:03:39,130
commercial airline a wide-body airliner

92
00:03:44,190 --> 00:03:41,430
that was used for commercial air travel

93
00:03:48,030 --> 00:03:44,200
we purchased that aircraft back in the

94
00:03:50,190 --> 00:03:48,040
in the early 90s we had to beef up the

95
00:03:52,650 --> 00:03:50,200
structure of the airplane to carry the

96
00:03:55,110 --> 00:03:52,660
Pegasus XL launch vehicle which weighs

97
00:03:57,000 --> 00:03:55,120
about 57 thousand pounds so a standard

98
00:03:59,310 --> 00:03:57,010
commercial airliner could not handle

99
00:04:00,990 --> 00:03:59,320
that kind of a load and so we beefed up

100
00:04:03,480 --> 00:04:01,000
the structure of the l-1011 to be able

101
00:04:05,180 --> 00:04:03,490
to carry the load as well as to drop the

102
00:04:07,500 --> 00:04:05,190
load so there's a pretty sophisticated

103
00:04:08,850 --> 00:04:07,510
hook release mechanism underneath the

104
00:04:11,520 --> 00:04:08,860
aircraft that interfaces with the

105
00:04:14,580 --> 00:04:11,530
pegasus rocket cool so you talked about

106
00:04:18,240 --> 00:04:14,590
beefing up an airplane so when I walk on

107
00:04:20,370 --> 00:04:18,250
board this airplane historically used

108
00:04:22,020 --> 00:04:20,380
for commercial airline purposes am I

109
00:04:23,700 --> 00:04:22,030
gonna see you first-class coach the

110
00:04:25,500 --> 00:04:23,710
whole kitten caboodle inside yeah well

111
00:04:26,200 --> 00:04:25,510
we don't make our team sitting in the

112
00:04:27,820 --> 00:04:26,210
back we don't

113
00:04:30,070 --> 00:04:27,830

coach they're they're sitting in what

114
00:04:32,350 --> 00:04:30,080
used to be the first class section but

115
00:04:35,110 --> 00:04:32,360
of course it's been heavily modified to

116
00:04:38,200 --> 00:04:35,120
include our launch panels for

117
00:04:40,210 --> 00:04:38,210
controlling the rocket systems all the

118
00:04:42,400 --> 00:04:40,220
systems onboard the Pegasus

119
00:04:45,370 --> 00:04:42,410
we have launch panel operators that fly

120
00:04:47,800 --> 00:04:45,380
out to the launch point and monitor the

121
00:04:49,870 --> 00:04:47,810
systems on the rock at real-time as well

122
00:04:53,290 --> 00:04:49,880
as the payload systems are monitored

123
00:04:56,620 --> 00:04:53,300
from a consoles up in that first class

124
00:04:58,600 --> 00:04:56,630
area the entire back end of the aircraft

125
00:05:01,499 --> 00:04:58,610
has been cleaned out of all all the

126
00:05:03,909 --> 00:05:01,509
seats and all the overhead bins and we

127
00:05:08,860 --> 00:05:03,919
like to refer to it as the bowling alley

128
00:05:10,719 --> 00:05:08,870
back there it's just do you bow back but

129
00:05:13,330 --> 00:05:10,729
it's it's empty in that it gives us

130
00:05:16,330 --> 00:05:13,340
additional performance capability to

131
00:05:17,560 --> 00:05:16,340
launch this this amazing machine can you

132
00:05:18,580 --> 00:05:17,570
launch anywhere in the world if you're

133
00:05:20,980 --> 00:05:18,590
on an airliner I would think that

134
00:05:22,570 --> 00:05:20,990
anywhere you can leave a runway from you

135
00:05:23,920 --> 00:05:22,580
could that's right and that's the that's

136
00:05:25,270 --> 00:05:23,930
the true advantage of an air launch

137
00:05:27,040 --> 00:05:25,280
system it gives you that global

138
00:05:29,529 --> 00:05:27,050

flexibility in fact we've launched

139
00:05:31,600 --> 00:05:29,539
Pegasus from the Canary Islands we've

140
00:05:33,879 --> 00:05:31,610
launched it from the Kwajalein atoll out

141
00:05:36,760 --> 00:05:33,889
in the middle of the Pacific Ocean as

142
00:05:38,200 --> 00:05:36,770
well as more conventional launch sites

143
00:05:40,300 --> 00:05:38,210
like Kennedy Space Center and Cape

144
00:05:43,060 --> 00:05:40,310
Canaveral Air Force Station so it truly

145
00:05:45,279 --> 00:05:43,070
is an independent launch platform that

146
00:05:47,020 --> 00:05:45,289
gives us lots of flexibility and really

147
00:05:50,050 --> 00:05:47,030
enables Pegasus to deliver payloads to

148
00:05:51,850 --> 00:05:50,060
any inclination cool so for this launch

149
00:05:53,379 --> 00:05:51,860
if I remember correctly we were actually

150
00:05:54,939 --> 00:05:53,389
supposed to launch from the Kwajalein

151
00:05:57,040 --> 00:05:54,949
Islands is that correct yeah that's

152
00:05:58,990 --> 00:05:57,050
right the original launch attempt was

153
00:06:00,129 --> 00:05:59,000
was designed to go out of Kwajalein and

154
00:06:03,189 --> 00:06:00,139
that was because we get a performance

155
00:06:05,140 --> 00:06:03,199
boost by launching near the equator okay

156
00:06:06,760 --> 00:06:05,150
rocket equation helps you it helps you

157
00:06:09,490 --> 00:06:06,770
understand that the closer you are the

158
00:06:12,159 --> 00:06:09,500
query the more the Earth's rotation

159
00:06:13,719 --> 00:06:12,169
helps you sure and it turns out that we

160
00:06:15,909 --> 00:06:13,729
really didn't need that performance that

161
00:06:18,670 --> 00:06:15,919
the icon spacecraft came in

162
00:06:20,320 --> 00:06:18,680
significantly under budget on mass okay

163
00:06:21,790 --> 00:06:20,330

instead that enabled us for this launch

164
00:06:23,439 --> 00:06:21,800
attempt to come back here to the Cape

165
00:06:26,589 --> 00:06:23,449
where logistically it's a it's a much

166
00:06:29,560 --> 00:06:26,599
more straightforward operation I think

167
00:06:33,249 --> 00:06:29,570
about launching a rocket and just the

168
00:06:36,189 --> 00:06:33,259
orbital mechanics of blasting a giant

169
00:06:37,629 --> 00:06:36,199
machine into outer space and getting it

170
00:06:39,399 --> 00:06:37,639
into an orbit you want like that's

171
00:06:40,989 --> 00:06:39,409
difficult but now

172
00:06:42,070 --> 00:06:40,999
adding like all of that with the

173
00:06:44,769 --> 00:06:42,080
complexity of now we're flying through

174
00:06:46,600 --> 00:06:44,779
the air to do that is it is it harder to

175
00:06:48,100 --> 00:06:46,610
like to launch from a plane and get

176
00:06:50,409 --> 00:06:48,110
things where you want them in space

177
00:06:52,779 --> 00:06:50,419
well there's challenges with with both

178
00:06:54,639 --> 00:06:52,789
approaches to to space launch you have

179
00:06:56,589 --> 00:06:54,649
additional systems though when you when

180
00:06:58,719 --> 00:06:56,599
you involve an airplane so not only does

181
00:07:00,820 --> 00:06:58,729
the rocket and all its systems have to

182
00:07:01,929 --> 00:07:00,830
perform flawlessly in order to get to a

183
00:07:02,859 --> 00:07:01,939
launch attempt didn't to have a

184
00:07:04,540 --> 00:07:02,869
successful launch

185
00:07:06,999 --> 00:07:04,550
but that aircraft has to perform

186
00:07:08,679 --> 00:07:07,009
flawlessly at all the systems onboard so

187
00:07:10,719 --> 00:07:08,689
it does add some complexity to it but

188
00:07:12,159 --> 00:07:10,729

the payoff is that flexibility on launch

189
00:07:15,939 --> 00:07:12,169
location we talked about a minute ago

190
00:07:18,549 --> 00:07:15,949
okay and and I'm assuming that this

191
00:07:20,379 --> 00:07:18,559
isn't the kind of thing where we have a

192
00:07:22,719 --> 00:07:20,389
rocket strapped to an airplane and the

193
00:07:24,040 --> 00:07:22,729
rocket just ignites that seems like that

194
00:07:25,839 --> 00:07:24,050
would be dangerous for the people on

195
00:07:27,339 --> 00:07:25,849
board so what's that process what's the

196
00:07:28,959 --> 00:07:27,349
actual launch sequence look like yeah

197
00:07:32,619 --> 00:07:28,969
there there are seven Souls onboard this

198
00:07:34,059 --> 00:07:32,629
air yeah and so our priority at Northrop

199
00:07:35,529 --> 00:07:34,069
Grumman is all about those seven people

200
00:07:37,809 --> 00:07:35,539
right in them and the main thing is

201
00:07:40,059 --> 00:07:37,819
safety and safety is always first in our

202
00:07:41,559 --> 00:07:40,069
minds for any operation particularly

203
00:07:42,790 --> 00:07:41,569
this one which is more hazardous than

204
00:07:44,980 --> 00:07:42,800
usual

205
00:07:47,350 --> 00:07:44,990
the Pegasus systems and the systems

206
00:07:49,089 --> 00:07:47,360
onboard the l-1011 are designed to

207
00:07:51,489 --> 00:07:49,099
monitor all the safety systems onboard

208
00:07:54,819 --> 00:07:51,499
the rocket and to ensure that we've got

209
00:07:57,399 --> 00:07:54,829
a safe condition in order to launch when

210
00:07:59,499 --> 00:07:57,409
we actually launch the the the Pegasus

211
00:08:01,329 --> 00:07:59,509
it's released from the l-1011 there's a

212
00:08:03,969 --> 00:08:01,339
there's a there's a button up in the

213
00:08:05,889 --> 00:08:03,979

cockpit that the pilot actually presses

214
00:08:07,329 --> 00:08:05,899
to release Pegasus it's a manual

215
00:08:09,549 --> 00:08:07,339
operation and that pilot isn't

216
00:08:12,100 --> 00:08:09,559
comfortable with where things are he

217
00:08:13,569 --> 00:08:12,110
won't release but once it does release

218
00:08:16,179 --> 00:08:13,579
it actually coasts away from the

219
00:08:17,709 --> 00:08:16,189
aircraft for five seconds the aircraft

220
00:08:19,689 --> 00:08:17,719
banks at that point because it's just

221
00:08:21,790 --> 00:08:19,699
released fifty-seven thousand pounds and

222
00:08:24,759 --> 00:08:21,800
you can imagine it's gonna get my

223
00:08:26,559 --> 00:08:24,769
sellout - yeah quickly yeah and it's

224
00:08:28,149 --> 00:08:26,569
that separation in that five seconds

225
00:08:31,839 --> 00:08:28,159
that puts the rock at a safe distance

226
00:08:34,509 --> 00:08:31,849
away from the l-1011 and the crew to

227
00:08:38,350 --> 00:08:34,519
ensure safety which is again our highest

228
00:08:40,119 --> 00:08:38,360
priority cool so does this mean that do

229
00:08:42,339 --> 00:08:40,129
you have a traditional launch countdown

230
00:08:43,659 --> 00:08:42,349
then if ultimately the pyro is the pilot

231
00:08:45,460 --> 00:08:43,669
held - like when we get to zero like you

232
00:08:47,199 --> 00:08:45,470
got to push the button it's he's

233
00:08:49,449 --> 00:08:47,209
flexible so we don't have an auto

234
00:08:51,280 --> 00:08:49,459
sequencer for example like most ground

235
00:08:54,010 --> 00:08:51,290
launch vehicles will go

236
00:08:55,540 --> 00:08:54,020
to internal power and then go within two

237
00:08:57,460 --> 00:08:55,550
minutes or so they'll go into an auto

238
00:08:59,530 --> 00:08:57,470

sequence where the computer on board

239
00:09:01,540 --> 00:08:59,540
that rocket is actually controlling the

240
00:09:03,610 --> 00:09:01,550
ignition pulse it's monitoring in and

241
00:09:05,650 --> 00:09:03,620
that can be turned off by people on the

242
00:09:07,060 --> 00:09:05,660
ground by operators on the ground but

243
00:09:08,710 --> 00:09:07,070
everything is automated unless it's

244
00:09:11,860 --> 00:09:08,720
interrupted by an operator in the case

245
00:09:14,860 --> 00:09:11,870
of Pegasus the the pilot has control of

246
00:09:18,030 --> 00:09:14,870
that event and none of the systems to

247
00:09:20,530 --> 00:09:18,040
start the the actual launch sequence

248
00:09:24,340 --> 00:09:20,540
initiate until the rocket is released

249
00:09:26,890 --> 00:09:24,350
from the airplane and for launching the

250
00:09:28,240 --> 00:09:26,900
rocket again thinking about an ground

251
00:09:30,550 --> 00:09:28,250
launch you're launching from a very

252
00:09:32,380 --> 00:09:30,560
specific point on earth do you have like

253
00:09:33,820 --> 00:09:32,390
one single spot in the air that like you

254
00:09:34,960 --> 00:09:33,830
have to hit that that moment and like

255
00:09:37,150 --> 00:09:34,970
ask everything to be perfect at that

256
00:09:39,760 --> 00:09:37,160
moment in space to launch oh it's called

257
00:09:42,490 --> 00:09:39,770
we call it the launch box and so the the

258
00:09:45,820 --> 00:09:42,500
l-1011 pilots will fly take off here

259
00:09:47,500 --> 00:09:45,830
from the kids skid script excuse me the

260
00:09:51,370 --> 00:09:47,510
pilots will take off here from the skid

261
00:09:52,720 --> 00:09:51,380
strip at Cape Canaveral and fly out and

262
00:09:55,570 --> 00:09:52,730
then apply what we call a racetrack

263
00:09:57,790 --> 00:09:55,580

which positions the aircraft at the

264
00:10:00,670 --> 00:09:57,800
right time at the right place for the

265
00:10:03,220 --> 00:10:00,680
drop they will they will align the

266
00:10:05,560 --> 00:10:03,230
aircraft with a drop box it's ten miles

267
00:10:07,900 --> 00:10:05,570
by 40 miles long okay

268
00:10:10,930 --> 00:10:07,910
and they they need to be inside of that

269
00:10:13,780 --> 00:10:10,940
box for the actual drop and launch of

270
00:10:15,460 --> 00:10:13,790
Pegasus all the all the the mission

271
00:10:17,560 --> 00:10:15,470
planning all the Range Safety is

272
00:10:20,530 --> 00:10:17,570
designed around dropping the rocket

273
00:10:22,780 --> 00:10:20,540
inside of that box so as long as you're

274
00:10:25,540 --> 00:10:22,790
in that box the rocket can kind of

275
00:10:26,800 --> 00:10:25,550
adjust so to speak in flight to get

276
00:10:28,420 --> 00:10:26,810
where needs to be that's right the the

277
00:10:30,070 --> 00:10:28,430
rocket will guide itself into orbit

278
00:10:31,360 --> 00:10:30,080
based on where it's released and if

279
00:10:33,580 --> 00:10:31,370
we're going a little bit too fast or a

280
00:10:36,190 --> 00:10:33,590
little bit too slow or we're ten miles

281
00:10:37,960 --> 00:10:36,200
shorter than what our nominal is the

282
00:10:39,580 --> 00:10:37,970
onboard navigation systems on the

283
00:10:41,530 --> 00:10:39,590
Pegasus will correct for that and get us

284
00:10:42,450 --> 00:10:41,540
into a very precise orbit cool that's

285
00:10:45,970 --> 00:10:42,460
great

286
00:10:48,280 --> 00:10:45,980
so you personally where are you gonna be

287
00:10:49,780 --> 00:10:48,290
for lunch do you have a roll are you on

288
00:10:52,240 --> 00:10:49,790

console somewhere yeah I'll be in the

289
00:10:54,850 --> 00:10:52,250
mission directors Center I I'm kind of a

290
00:10:57,550 --> 00:10:54,860
suit though so so so the real the real

291
00:11:01,020 --> 00:10:57,560
the real rocket operators are the

292
00:11:03,600 --> 00:11:01,030
Pegasus launch team the

293
00:11:05,790 --> 00:11:03,610
the mission director for Northrop

294
00:11:08,370 --> 00:11:05,800
Grumman is Brian Baldwin who is our

295
00:11:10,980 --> 00:11:08,380
program manager for Pegasus and the rest

296
00:11:14,640 --> 00:11:10,990
of the launch team including the launch

297
00:11:15,960 --> 00:11:14,650
conductor are there in building a EE in

298
00:11:18,180 --> 00:11:15,970
launch control cool

299
00:11:21,210 --> 00:11:18,190
so I would be remiss if I didn't ask you

300
00:11:22,940 --> 00:11:21,220
because Icahn has been I don't know how

301
00:11:26,040 --> 00:11:22,950
to describe it we've had some delays

302
00:11:29,010 --> 00:11:26,050
this time almost almost exactly a year

303
00:11:30,300 --> 00:11:29,020
ago it seems like we were up we the

304
00:11:32,850 --> 00:11:30,310
plane had taken off we were about 30

305
00:11:34,410 --> 00:11:32,860
minutes from launch and and we scrubbed

306
00:11:37,020 --> 00:11:34,420
out and we're back here again almost

307
00:11:38,400 --> 00:11:37,030
about a year later so can you tell us

308
00:11:40,110 --> 00:11:38,410
kind of what happened what's happened

309
00:11:42,960 --> 00:11:40,120
over the course of the past year sure

310
00:11:45,120 --> 00:11:42,970
yeah the the you know any space launch

311
00:11:47,730 --> 00:11:45,130
requires flawless operation of a highly

312
00:11:49,950 --> 00:11:47,740
complex machine made up of thousands of

313
00:11:52,350 --> 00:11:49,960

parts software and launch operations

314
00:11:55,710 --> 00:11:52,360
that must execute perfectly every launch

315
00:11:57,150 --> 00:11:55,720
every time the Pegasus icon mission has

316
00:11:59,970 --> 00:11:57,160
challenged the Northrop Grumman NASA

317
00:12:01,800 --> 00:11:59,980
team repeatedly but we're excited to say

318
00:12:04,170 --> 00:12:01,810
that we're they're past those challenges

319
00:12:06,720 --> 00:12:04,180
and are ready to go during the previous

320
00:12:09,570 --> 00:12:06,730
launch attempt engineers observed some

321
00:12:12,000 --> 00:12:09,580
anomalous readings on a position

322
00:12:14,010 --> 00:12:12,010
feedback sensor on the Pegasus rudder

323
00:12:15,960 --> 00:12:14,020
fin actuator the rudder is really what

324
00:12:18,000 --> 00:12:15,970
steers the rocket during the first stage

325
00:12:19,560 --> 00:12:18,010
of flight it's like an airplane so it's

326
00:12:22,110 --> 00:12:19,570
got a rudder just like an airplane does

327
00:12:24,329 --> 00:12:22,120
and it was that position feedback that

328
00:12:26,070 --> 00:12:24,339
looked uh nominalist to us and caused us

329
00:12:28,230 --> 00:12:26,080
to scrub that previous launch attempt

330
00:12:29,670 --> 00:12:28,240
because the mission successes are only

331
00:12:32,070 --> 00:12:29,680
focused and because we did not have a

332
00:12:34,500 --> 00:12:32,080
clear understanding of those readings we

333
00:12:35,940 --> 00:12:34,510
stood up a joint investigation team with

334
00:12:38,400 --> 00:12:35,950
our NASA partners to determine caused

335
00:12:40,110 --> 00:12:38,410
and corrective actions those corrective

336
00:12:42,470 --> 00:12:40,120
actions included removing and replacing

337
00:12:45,060 --> 00:12:42,480
hardware with modified designs

338
00:12:46,800 --> 00:12:45,070

performing qualification testing and

339
00:12:48,780 --> 00:12:46,810
conducting three captive carry flights

340
00:12:51,420 --> 00:12:48,790
to validate the hard hardware upgrades

341
00:12:52,829 --> 00:12:51,430
including the one that we flew to ferry

342
00:12:55,800 --> 00:12:52,839
the rocket from Vandenberg Air Force

343
00:12:57,150 --> 00:12:55,810
Base here to here to Florida working

344
00:12:59,450 --> 00:12:57,160
through those challenges as a team was

345
00:13:01,500 --> 00:12:59,460
the only possible due to the outstanding

346
00:13:03,930 --> 00:13:01,510
three-decade partnership we've had with

347
00:13:06,240 --> 00:13:03,940
NASA on Pegasus and we are proud and

348
00:13:08,820 --> 00:13:06,250
honored to be here to launch yeah

349
00:13:10,920 --> 00:13:08,830
obviously Northrop Grumman is a big part

350
00:13:13,350 --> 00:13:10,930
of our launch services program obviously

351
00:13:15,420 --> 00:13:13,360
a big mission here with Ikon so glad to

352
00:13:16,920 --> 00:13:15,430
have a year it sounds like

353
00:13:19,410 --> 00:13:16,930
probably a tough year but probably

354
00:13:20,730 --> 00:13:19,420
feeling really rewarding now I guess

355
00:13:21,960 --> 00:13:20,740
we're getting ready to like hey we did

356
00:13:23,400 --> 00:13:21,970
this the right way we're gonna get there

357
00:13:25,560 --> 00:13:23,410
I think everybody involved would say was

358
00:13:28,620 --> 00:13:25,570
a very intense year very time is of the

359
00:13:32,190 --> 00:13:28,630
essence in these sorts of things and we

360
00:13:33,390 --> 00:13:32,200
worked almost around the clock to to get

361
00:13:35,870 --> 00:13:33,400
to the bottom of this and what was

362
00:13:38,460 --> 00:13:35,880
really happening on the Northrop

363
00:13:41,610 --> 00:13:38,470

Northrop Grumman team working with NASA

364
00:13:43,980 --> 00:13:41,620
hand-in-hand and that activity so so

365
00:13:46,020 --> 00:13:43,990
it's it is very rewarding to get past it

366
00:13:48,000 --> 00:13:46,030
to really understand what's happening to

367
00:13:50,370 --> 00:13:48,010
make those corrective actions and in

368
00:13:52,650 --> 00:13:50,380
fact we we grew we gained great

369
00:13:54,510 --> 00:13:52,660
confidence on the ferry flight from

370
00:13:56,400 --> 00:13:54,520
California to here where we didn't see a

371
00:13:59,280 --> 00:13:56,410
repeat of any of the issues we had in

372
00:14:02,940 --> 00:13:59,290
the previous launch attempts so I'm

373
00:14:04,080 --> 00:14:02,950
assuming that this is a mission every

374
00:14:06,360 --> 00:14:04,090
mission is this way but I'm sure in

375
00:14:08,520 --> 00:14:06,370
particular your team is excited for this

376
00:14:09,870 --> 00:14:08,530
launch and anxious for it so what's that

377
00:14:12,450 --> 00:14:09,880
gonna feel like to see this thing fly

378
00:14:14,040 --> 00:14:12,460
and be in orbit correctly like how's the

379
00:14:16,650 --> 00:14:14,050
team respond to that well any any any

380
00:14:18,360 --> 00:14:16,660
launches is is all adrenalin and and and

381
00:14:20,370 --> 00:14:18,370
you know it's one of the reasons we're

382
00:14:22,100 --> 00:14:20,380
in this business it's it's it's a blast

383
00:14:25,920 --> 00:14:22,110
right and no pun intended

384
00:14:27,510 --> 00:14:25,930
but this one in particular because of

385
00:14:29,310 --> 00:14:27,520
all the effort that we've had to put in

386
00:14:31,950 --> 00:14:29,320
to get this right on both sides you know

387
00:14:34,170 --> 00:14:31,960
on the payload side the NASA side and

388
00:14:36,030 --> 00:14:34,180

the north of Grumman side the teams the

389
00:14:37,140 --> 00:14:36,040
teams that that solve this problem with

390
00:14:39,570 --> 00:14:37,150
the teams that are going to be launching

391
00:14:41,820 --> 00:14:39,580
the rocket and I I can't imagine that

392
00:14:44,940 --> 00:14:41,830
they don't have an extra boost of

393
00:14:46,710 --> 00:14:44,950
adrenaline for this mission compared to

394
00:14:49,440 --> 00:14:46,720
others although they're all they're all

395
00:14:51,510 --> 00:14:49,450
very exciting yeah so you you you

396
00:14:53,280 --> 00:14:51,520
describe yourself as being a suit so

397
00:14:56,310 --> 00:14:53,290
kind of as a leader of this this group

398
00:14:57,450 --> 00:14:56,320
does that hold specific meaning for you

399
00:14:59,430 --> 00:14:57,460
and kind of like your history with the

400
00:15:01,680 --> 00:14:59,440
rocket yeah the Pegasus team is a family

401
00:15:03,090 --> 00:15:01,690
been together for you know since 1990

402
00:15:05,190 --> 00:15:03,100
and a lot of the people that are working

403
00:15:08,850 --> 00:15:05,200
Pegasus have worked on on the program

404
00:15:10,560 --> 00:15:08,860
for over a decade so it's really

405
00:15:12,600 --> 00:15:10,570
rewarding to see them have the

406
00:15:14,790 --> 00:15:12,610
opportunity to get payoff for their

407
00:15:17,700 --> 00:15:14,800
efforts that we know it's gonna be a

408
00:15:18,960 --> 00:15:17,710
successful mission cool so I want to go

409
00:15:21,180 --> 00:15:18,970
back real fast there was a comment you

410
00:15:23,360 --> 00:15:21,190
made that and I heard that with the

411
00:15:25,650 --> 00:15:23,370
Pegasus ferry flight across the country

412
00:15:28,560 --> 00:15:25,660
with a commercial airliner if you're

413
00:15:29,369 --> 00:15:28,570

flying yourself from LA to Orlando you

414
00:15:31,559 --> 00:15:29,379
just kind of take as

415
00:15:33,960 --> 00:15:31,569
straighter path as you can but I believe

416
00:15:35,699 --> 00:15:33,970
I've heard that the l-1011 and the

417
00:15:37,859 --> 00:15:35,709
pegasus take a very different path to

418
00:15:39,900 --> 00:15:37,869
get here is that correct yes we have to

419
00:15:42,499 --> 00:15:39,910
file a special flight flight plan with

420
00:15:46,529 --> 00:15:42,509
the FAA because we're we are carrying

421
00:15:48,659 --> 00:15:46,539
50,000 pounds of rocket fuel so we do

422
00:15:50,699 --> 00:15:48,669
avoid populated areas along the flight

423
00:15:52,199 --> 00:15:50,709
path but but it's not all that different

424
00:15:54,269 --> 00:15:52,209
that people that are riding there is

425
00:15:56,339 --> 00:15:54,279
about a five five and a half five and a

426
00:15:57,989 --> 00:15:56,349
half hour flight and we take advantage

427
00:15:59,639 --> 00:15:57,999
of this flight to monitor the systems

428
00:16:01,829 --> 00:15:59,649
onboard so it's actually a dry run for

429
00:16:03,539 --> 00:16:01,839
our launch attempt right we've got the

430
00:16:05,069 --> 00:16:03,549
system's powered up we're not arming

431
00:16:07,739 --> 00:16:05,079
anything or doing anything will do for

432
00:16:08,969 --> 00:16:07,749
an actual launch but we will monitor all

433
00:16:11,219 --> 00:16:08,979
the systems and in fact we were

434
00:16:13,859 --> 00:16:11,229
monitoring the system that gave us the

435
00:16:16,649 --> 00:16:13,869
issues the entire flight from Vandenberg

436
00:16:20,279 --> 00:16:16,659
to Florida and then when we get here we

437
00:16:22,279 --> 00:16:20,289
actually will practice before we land on

438
00:16:24,779 --> 00:16:22,289

the skid strip we'll actually practice

439
00:16:27,119 --> 00:16:24,789
not a launch attempt but basically going

440
00:16:29,039 --> 00:16:27,129
out to the racetrack turning our

441
00:16:30,979 --> 00:16:29,049
transmitters on having the range capture

442
00:16:33,329 --> 00:16:30,989
that data and it's a really good dry run

443
00:16:35,009 --> 00:16:33,339
not just for the Pegasus team for but

444
00:16:37,169 --> 00:16:35,019
but for the range as well to make sure

445
00:16:38,909 --> 00:16:37,179
everything is set properly and we're

446
00:16:41,039 --> 00:16:38,919
ready for launch day cool Phil

447
00:16:42,809 --> 00:16:41,049
appreciate you good luck to you and the

448
00:16:45,269 --> 00:16:42,819
entire team obviously we're all gonna be

449
00:16:46,829 --> 00:16:45,279
anxious to see this one fly as with any

450
00:16:48,869 --> 00:16:46,839
launch but certainly like overcoming

451
00:16:50,519 --> 00:16:48,879
challenges is what makes NASA or

452
00:16:53,309 --> 00:16:50,529
Northrop Grumman great great to be here

453
00:16:54,689 --> 00:16:53,319
thank you very much i wrangled up

454
00:16:56,099 --> 00:16:54,699
another ranch hand to help track down

455
00:16:58,529 --> 00:16:56,109
some more information on this

456
00:17:01,139 --> 00:16:58,539
long-awaited mission here's my colleague

457
00:17:03,090 --> 00:17:01,149
Madison Tuttle with dr. Nikki Fox the

458
00:17:05,119 --> 00:17:03,100
heliophysics division director in the

459
00:17:07,619 --> 00:17:05,129
NASA science Mission Directorate and

460
00:17:09,809 --> 00:17:07,629
principal investigator for icon from the

461
00:17:14,429 --> 00:17:09,819
Space Sciences laboratory at UC Berkeley

462
00:17:16,799 --> 00:17:14,439
dr. Thomas MO all right I am here in the

463
00:17:19,499 --> 00:17:16,809

booth with Ikon principal investigator

464
00:17:21,990 --> 00:17:19,509
dr. Thomas Emel and we also have dr.

465
00:17:23,850 --> 00:17:22,000
Nikki Fox who is the director of the

466
00:17:26,970 --> 00:17:23,860
Helio physics division from NASA

467
00:17:28,830 --> 00:17:26,980
headquarters welcome to you both if we

468
00:17:31,320 --> 00:17:28,840
want to start out you could just give me

469
00:17:33,149 --> 00:17:31,330
kind of a brief high-level overview of

470
00:17:34,889 --> 00:17:33,159
kind of your role in the icon mission

471
00:17:37,200 --> 00:17:34,899
Tom if you like to start being the

472
00:17:41,130 --> 00:17:37,210
principal investigator I'm responsible

473
00:17:43,080 --> 00:17:41,140
for the scientific output of the

474
00:17:47,040 --> 00:17:43,090
I'm working with a team of scientists

475
00:17:49,020 --> 00:17:47,050
and to define the science goals and

476
00:17:51,690 --> 00:17:49,030
which we have well defined at this point

477
00:17:56,100 --> 00:17:51,700
and agree with NASA and what those were

478
00:17:59,340 --> 00:17:56,110
and then you know I Berkeley was

479
00:18:01,290 --> 00:17:59,350
responsible for putting together the

480
00:18:02,690 --> 00:18:01,300
observatory so of course we've worked

481
00:18:05,280 --> 00:18:02,700
with a number of partners on that

482
00:18:07,620 --> 00:18:05,290
including Northrop Grumman for the

483
00:18:10,440 --> 00:18:07,630
spacecraft and to integrate the payload

484
00:18:12,780 --> 00:18:10,450
the scientific payload to the with the

485
00:18:14,820 --> 00:18:12,790
spacecraft to create the observatory we

486
00:18:16,650 --> 00:18:14,830
also worked with Utah State to integrate

487
00:18:18,470 --> 00:18:16,660
the all the instruments on the payload

488
00:18:21,840 --> 00:18:18,480

and we have instruments from Dallas

489
00:18:24,360 --> 00:18:21,850
University of Dallas and in a research

490
00:18:26,490 --> 00:18:24,370
lab as well as Berkley imagers we were

491
00:18:28,500 --> 00:18:26,500
selected by NASA to do this mission in

492
00:18:30,630 --> 00:18:28,510
2013 and it's been a long road but we're

493
00:18:35,730 --> 00:18:30,640
finally glad to be launching it this

494
00:18:37,620 --> 00:18:35,740
week yeah dr. Nikki Fox so in my role I

495
00:18:40,080 --> 00:18:37,630
am responsible for all of the spacecraft

496
00:18:42,180 --> 00:18:40,090
and all of the assets that make up the

497
00:18:45,540 --> 00:18:42,190
Helio fleet and so we are very excited

498
00:18:47,850 --> 00:18:45,550
we have obviously missions looking at

499
00:18:49,290 --> 00:18:47,860
the Sun tracking all of those events all

500
00:18:51,690 --> 00:18:49,300
the way through the space between the

501
00:18:53,880 --> 00:18:51,700
Sun and Earth and then icon joining our

502
00:18:56,160 --> 00:18:53,890
fleet to really look at that sort of

503
00:18:58,100 --> 00:18:56,170
final piece what happens when all of

504
00:19:00,630 --> 00:18:58,110
that solar energy gets into our

505
00:19:02,670 --> 00:19:00,640
atmosphere and dumps a lot of energy

506
00:19:05,100 --> 00:19:02,680
there and what is happening in that sort

507
00:19:07,380 --> 00:19:05,110
of very dynamic region where icon is

508
00:19:09,720 --> 00:19:07,390
going to be flying through and it's a

509
00:19:11,700 --> 00:19:09,730
wonderful partnership we have a imager

510
00:19:13,620 --> 00:19:11,710
up there called gold that was launched

511
00:19:17,040 --> 00:19:13,630
last year and that is taking full

512
00:19:18,840 --> 00:19:17,050
hemispheric images from its it's sort of

513
00:19:20,730 --> 00:19:18,850

vantage point at geosynchronous orbit

514
00:19:23,280 --> 00:19:20,740
and then Ikon will be whipping through

515
00:19:25,890 --> 00:19:23,290
making the in situ data telling us

516
00:19:27,750 --> 00:19:25,900
exactly what is happening kind of out in

517
00:19:30,300 --> 00:19:27,760
that environment so we can't wait

518
00:19:31,980 --> 00:19:30,310
perfect and how big is your team in

519
00:19:33,780 --> 00:19:31,990
total do you know how many people are

520
00:19:36,510 --> 00:19:33,790
involved with this mission well let's

521
00:19:38,610 --> 00:19:36,520
see between Northrop and the launch

522
00:19:39,990 --> 00:19:38,620
vehicle Northrop so Northrop also has

523
00:19:43,410 --> 00:19:40,000
the launch vehicle as well as the

524
00:19:46,410 --> 00:19:43,420
spacecraft so there will be probably 16

525
00:19:48,180 --> 00:19:46,420
northrop engineers on console at

526
00:19:50,250 --> 00:19:48,190
berkeley when we launch where the

527
00:19:52,700 --> 00:19:50,260
mission operations are and then there's

528
00:19:54,740 --> 00:19:52,710
so many people here for the rocket so

529
00:19:56,539 --> 00:19:54,750
hundreds of people yeah we always say

530
00:19:59,570 --> 00:19:56,549
it's takes an entire family to put a

531
00:20:01,190 --> 00:19:59,580
spacecraft into orbit you you just don't

532
00:20:04,100 --> 00:20:01,200
realize how many people and they all

533
00:20:05,480 --> 00:20:04,110
have a very very vital role and it's you

534
00:20:07,159 --> 00:20:05,490
know one of the beauties beautiful

535
00:20:09,470 --> 00:20:07,169
things about doing these is getting to

536
00:20:12,019 --> 00:20:09,480
work in these incredible teams right and

537
00:20:13,580 --> 00:20:12,029
you touch briefly kind of what icon is

538
00:20:15,500 --> 00:20:13,590

going to be doing could you explain to

539
00:20:21,370 --> 00:20:15,510
our listeners a little bit just in

540
00:20:24,049 --> 00:20:21,380
general what is the ionosphere I can

541
00:20:26,720 --> 00:20:24,059
well the ionosphere is the region around

542
00:20:29,480 --> 00:20:26,730
Earth that's charged or it's been

543
00:20:33,039 --> 00:20:29,490
ionized by solar radiation that's how it

544
00:20:37,519 --> 00:20:33,049
gets ionized where that plasma goes and

545
00:20:40,010 --> 00:20:37,529
how it behaves after that is subject to

546
00:20:43,460 --> 00:20:40,020
a number of different inputs of course

547
00:20:45,440 --> 00:20:43,470
the aurora is another place where a lot

548
00:20:47,659 --> 00:20:45,450
of plasma is created that's by charged

549
00:20:49,100 --> 00:20:47,669
particles that initially come from the

550
00:20:51,289 --> 00:20:49,110
solar wind but the energize in the

551
00:20:53,120 --> 00:20:51,299
magnetosphere and then channeled into

552
00:20:54,919 --> 00:20:53,130
the high latitude regions of the earth

553
00:20:57,799 --> 00:20:54,929
that can modify the ionosphere pretty

554
00:21:01,700 --> 00:20:57,809
drastically ikons focuses on the forcing

555
00:21:04,250 --> 00:21:01,710
that comes from below most of the solar

556
00:21:05,539 --> 00:21:04,260
energy that comes from the Sun ends up

557
00:21:08,120 --> 00:21:05,549
on earth ends up right here in the

558
00:21:12,440 --> 00:21:08,130
surface and it turns out that a lot of

559
00:21:14,389 --> 00:21:12,450
energy and momentum is comes comes back

560
00:21:17,360 --> 00:21:14,399
up and that can come up in large-scale

561
00:21:20,269 --> 00:21:17,370
waves and there's a number of there's a

562
00:21:22,610 --> 00:21:20,279
family of waves and tides that can carry

563
00:21:24,740 --> 00:21:22,620

that energy back up into space and it

564
00:21:26,990 --> 00:21:24,750
turns out that we think that there's a

565
00:21:28,399 --> 00:21:27,000
that that's there maybe the key to

566
00:21:31,039 --> 00:21:28,409
understanding why the aina sphere is so

567
00:21:32,480 --> 00:21:31,049
variable and the key to making being

568
00:21:34,700 --> 00:21:32,490
able to make better predictions of its

569
00:21:36,440 --> 00:21:34,710
conditions certain we could describe the

570
00:21:38,779 --> 00:21:36,450
ionosphere maybe it's like a transition

571
00:21:40,190 --> 00:21:38,789
region if it's where the all of the

572
00:21:41,990 --> 00:21:40,200
weather that we worry about here on

573
00:21:44,720 --> 00:21:42,000
earth the Hurricanes and the tornadoes

574
00:21:46,250 --> 00:21:44,730
that's kind of reaching up and then that

575
00:21:47,690 --> 00:21:46,260
space weather from the Sun is coming

576
00:21:49,549 --> 00:21:47,700
down and it's that kind of handshake

577
00:21:51,649 --> 00:21:49,559
between those two different weather

578
00:21:53,630 --> 00:21:51,659
systems that is that that transition

579
00:21:55,970 --> 00:21:53,640
region that's the ionosphere that's

580
00:21:58,669 --> 00:21:55,980
right that's its space weather means

581
00:22:00,200 --> 00:21:58,679
Earth's weather in the ionosphere and we

582
00:22:03,230 --> 00:22:00,210
wouldn't have said that if decade ago

583
00:22:04,789 --> 00:22:03,240
sort of a surprising sort of outcome

584
00:22:06,409 --> 00:22:04,799
from previous NASA missions that's

585
00:22:08,029 --> 00:22:06,419
actually true we thought about a deck

586
00:22:10,159 --> 00:22:08,039
we thought everything was driven by the

587
00:22:12,049 --> 00:22:10,169
Sun and now we're finding out that it's

588
00:22:13,639 --> 00:22:12,059

so dynamic and there's so much energy

589
00:22:15,919 --> 00:22:13,649
there that there has to be something

590
00:22:18,379 --> 00:22:15,929
else it can't just be the Sun and so now

591
00:22:21,109 --> 00:22:18,389
we think it's actually energy that comes

592
00:22:23,659 --> 00:22:21,119
up from from our weather and where they

593
00:22:25,310 --> 00:22:23,669
meet that's the ionosphere so I kind of

594
00:22:27,379 --> 00:22:25,320
understand that like radio

595
00:22:29,840 --> 00:22:27,389
communications GPS signals also kind of

596
00:22:32,090 --> 00:22:29,850
float through the ionosphere obviously

597
00:22:33,830 --> 00:22:32,100
those have pretty big implications for

598
00:22:35,479 --> 00:22:33,840
our life here on earth I don't know if

599
00:22:37,430 --> 00:22:35,489
you guys want to elaborate a little bit

600
00:22:39,710 --> 00:22:37,440
kind of the importance of this mission

601
00:22:41,479 --> 00:22:39,720
just for the everyday person on earth

602
00:22:44,090 --> 00:22:41,489
yeah so the ionosphere is really you

603
00:22:45,769 --> 00:22:44,100
know that does that does often the radio

604
00:22:47,479 --> 00:22:45,779
signals bounce off the ionosphere or

605
00:22:49,820 --> 00:22:47,489
they travel through it and when the

606
00:22:52,369 --> 00:22:49,830
ionosphere is nice and quiet then we get

607
00:22:54,799 --> 00:22:52,379
those signals just just fine but when we

608
00:22:57,109 --> 00:22:54,809
have disturbances maybe like bubbles

609
00:22:59,060 --> 00:22:57,119
really bubbles a plasma that form in

610
00:23:01,039 --> 00:22:59,070
this region and they can adversely

611
00:23:03,859 --> 00:23:01,049
affect our ability to have these

612
00:23:06,799 --> 00:23:03,869
communications and that has effects for

613
00:23:08,419 --> 00:23:06,809

obviously military for FAA we want to be

614
00:23:11,090 --> 00:23:08,429
making sure our astronauts are safe

615
00:23:12,440 --> 00:23:11,100
they're all in this region and so we

616
00:23:12,820 --> 00:23:12,450
really need to study it and understand

617
00:23:17,720 --> 00:23:12,830
it

618
00:23:18,889 --> 00:23:17,730
instruments onboard the spacecraft I

619
00:23:20,690 --> 00:23:18,899
don't know if you want to talk a little

620
00:23:23,629 --> 00:23:20,700
bit about kind of each one in their role

621
00:23:25,460 --> 00:23:23,639
within the mission well I'll start with

622
00:23:28,070 --> 00:23:25,470
the wind imager so it's an

623
00:23:30,379 --> 00:23:28,080
interferometer and what that means is it

624
00:23:32,060 --> 00:23:30,389
causes it takes light into its aperture

625
00:23:34,609 --> 00:23:32,070
and it causes it to interfere with

626
00:23:37,580 --> 00:23:34,619
itself so you can very very carefully

627
00:23:39,919 --> 00:23:37,590
determine the wavelength of the light we

628
00:23:41,840 --> 00:23:39,929
can determine it so well that we can

629
00:23:43,190 --> 00:23:41,850
determine if the emission the place

630
00:23:45,259 --> 00:23:43,200
where the lights coming from is moving

631
00:23:47,659 --> 00:23:45,269
towards you or away from you who simply

632
00:23:51,169 --> 00:23:47,669
through Doppler shift of the of the

633
00:23:53,479 --> 00:23:51,179
light and so it's like telling it's like

634
00:23:55,810 --> 00:23:53,489
looking at someone across the room or if

635
00:23:57,680 --> 00:23:55,820
and looking at the color of their shirt

636
00:23:59,330 --> 00:23:57,690
icon could tell you if they're running

637
00:24:01,220 --> 00:23:59,340
towards you or away from you by the

638
00:24:02,690 --> 00:24:01,230

change in the color of their shirt so

639
00:24:04,669 --> 00:24:02,700
it's about five meters per second which

640
00:24:09,019 --> 00:24:04,679
I think I can do five meters per second

641
00:24:10,460 --> 00:24:09,029
I haven't tried but so that's an

642
00:24:11,989 --> 00:24:10,470
important measurement and also we get a

643
00:24:13,759 --> 00:24:11,999
temperature measurement from that as

644
00:24:14,930 --> 00:24:13,769
well that looks right down all those

645
00:24:16,339 --> 00:24:14,940
that wind and temperature we're

646
00:24:19,410 --> 00:24:16,349
measuring right down at the boundary of

647
00:24:21,420 --> 00:24:19,420
space so we say 60 miles

648
00:24:23,310 --> 00:24:21,430
hundred kilometers is that edge of space

649
00:24:24,810 --> 00:24:23,320
and we retrieve the winds and

650
00:24:28,440 --> 00:24:24,820
temperatures from there continually day

651
00:24:30,030 --> 00:24:28,450
and night and as at higher altitudes in

652
00:24:31,920 --> 00:24:30,040
the day when there's a lot of air glow

653
00:24:33,420 --> 00:24:31,930
and you can retrieve that information in

654
00:24:35,250 --> 00:24:33,430
the daytime also there's ultraviolet

655
00:24:37,710 --> 00:24:35,260
emissions we have ultraviolet to

656
00:24:41,250 --> 00:24:37,720
ultraviolet cameras that pull out the

657
00:24:43,800 --> 00:24:41,260
you can retrieve the composition of the

658
00:24:46,710 --> 00:24:43,810
upper atmosphere how it changes and also

659
00:24:47,730 --> 00:24:46,720
the ionospheric density profile we want

660
00:24:49,950 --> 00:24:47,740
to know where that peak in the

661
00:24:51,540 --> 00:24:49,960
atmosphere is at an altitude and how

662
00:24:53,430 --> 00:24:51,550
dense it is

663
00:24:56,190 --> 00:24:53,440

we also carry and set you measurements

664
00:24:58,020 --> 00:24:56,200
so what's remarkable is that in our

665
00:25:01,170 --> 00:24:58,030
orbit that we've selected we can measure

666
00:25:03,480 --> 00:25:01,180
the motion of the plasma that the plasma

667
00:25:06,270 --> 00:25:03,490
is you know is generated it's your honor

668
00:25:07,770 --> 00:25:06,280
in a magnetic field so what's affecting

669
00:25:10,530 --> 00:25:07,780
that plasma is sort of everything along

670
00:25:13,410 --> 00:25:10,540
that magnetic field in fact if you look

671
00:25:14,820 --> 00:25:13,420
down the field line you'll you end up at

672
00:25:16,770 --> 00:25:14,830
a place where we're making the wind and

673
00:25:18,420 --> 00:25:16,780
temperature measurements as well so as

674
00:25:20,070 --> 00:25:18,430
there's this sort of key observational

675
00:25:22,050 --> 00:25:20,080
characteristic to the mission that's not

676
00:25:24,000 --> 00:25:22,060
been done before so Icahn has been a

677
00:25:26,370 --> 00:25:24,010
mission six years in the making

678
00:25:29,580 --> 00:25:26,380
what challenges or frustrations have

679
00:25:30,930 --> 00:25:29,590
y'all faced all along the way you don't

680
00:25:32,850 --> 00:25:30,940
launch unless you know everything is

681
00:25:35,340 --> 00:25:32,860
going to be perfect and you know so

682
00:25:37,140 --> 00:25:35,350
there was some anomalous behavior when

683
00:25:38,940 --> 00:25:37,150
we tried to launch last year and I have

684
00:25:41,010 --> 00:25:38,950
to just give credit to the amazing team

685
00:25:43,110 --> 00:25:41,020
that really stood into this you know

686
00:25:44,970 --> 00:25:43,120
nobody ever gave up the icon team is

687
00:25:47,310 --> 00:25:44,980
still there still waiting for this

688
00:25:49,020 --> 00:25:47,320

mission we've even used the time to do

689
00:25:51,330 --> 00:25:49,030
some extra testing on the spacecraft

690
00:25:53,130 --> 00:25:51,340
walking out the solar arrays making sure

691
00:25:54,750 --> 00:25:53,140
everything is going to be perfect when

692
00:25:57,180 --> 00:25:54,760
we actually come to launch and there's

693
00:25:58,260 --> 00:25:57,190
only one icon it's not like we are going

694
00:25:59,490 --> 00:25:58,270
to launch it and if something goes wrong

695
00:26:02,340 --> 00:25:59,500
we're just gonna build another one

696
00:26:03,690 --> 00:26:02,350
there's only one icon and so we want to

697
00:26:05,940 --> 00:26:03,700
make sure everything is a hundred

698
00:26:08,970 --> 00:26:05,950
percent perfect before we launch our

699
00:26:11,070 --> 00:26:08,980
precious baby into space because you

700
00:26:12,660 --> 00:26:11,080
know it's it's just we've waited a long

701
00:26:14,370 --> 00:26:12,670
time we've got this incredible science

702
00:26:15,930 --> 00:26:14,380
we want to do this is the mission to go

703
00:26:17,490 --> 00:26:15,940
and answer it and we're certainly not

704
00:26:19,470 --> 00:26:17,500
gonna take any chances with it so

705
00:26:20,790 --> 00:26:19,480
everything good in life is worth waiting

706
00:26:22,800 --> 00:26:20,800
for and we just have to wait a little

707
00:26:24,570 --> 00:26:22,810
bit longer like Niki said we said you

708
00:26:26,250 --> 00:26:24,580
know Niki would we have to do is we have

709
00:26:27,660 --> 00:26:26,260
to open up the whole spacecraft again we

710
00:26:29,820 --> 00:26:27,670
have to test the spacecraft and all the

711
00:26:32,190 --> 00:26:29,830
instruments one more time

712
00:26:33,690 --> 00:26:32,200
and you know everyone at NASA understood

713
00:26:36,539 --> 00:26:33,700

why you have to do that's been it's been

714
00:26:38,159 --> 00:26:36,549
some time as we had to but we're talking

715
00:26:40,289 --> 00:26:38,169
to the engineers are very happy to have

716
00:26:42,120 --> 00:26:40,299
gone through that so we're ready

717
00:26:43,889 --> 00:26:42,130
is there anything just from a personal

718
00:26:45,990 --> 00:26:43,899
perspective what are you most looking

719
00:26:47,639 --> 00:26:46,000
forward to results from this mission

720
00:26:49,440 --> 00:26:47,649
observations from this mission is there

721
00:26:51,509 --> 00:26:49,450
anything in particular you're really

722
00:26:54,000 --> 00:26:51,519
anxious about I don't think we're

723
00:26:56,130 --> 00:26:54,010
actions were really excited you know as

724
00:26:59,759 --> 00:26:56,140
Tom noted we really started working on

725
00:27:02,009 --> 00:26:59,769
this mission in 2013 and that probably

726
00:27:03,539 --> 00:27:02,019
sounds like a long time but it takes a

727
00:27:05,970 --> 00:27:03,549
lot of time to put these really really

728
00:27:08,310 --> 00:27:05,980
sophisticated missions up in space and

729
00:27:10,320 --> 00:27:08,320
you have to have everything right and so

730
00:27:12,090 --> 00:27:10,330
you can't go up and and fix it you have

731
00:27:13,950 --> 00:27:12,100
to have everything right and so it does

732
00:27:15,930 --> 00:27:13,960
take a while it takes a village it takes

733
00:27:17,970 --> 00:27:15,940
a lot of teamwork to put it together and

734
00:27:19,500 --> 00:27:17,980
so I think we're all incredibly excited

735
00:27:22,019 --> 00:27:19,510
about seeing the science that is going

736
00:27:23,759 --> 00:27:22,029
to come from this mission really you

737
00:27:25,680 --> 00:27:23,769
know we've really formed the right

738
00:27:27,750 --> 00:27:25,690

questions I think to be asking over the

739
00:27:29,879 --> 00:27:27,760
last decade an icon is certainly the

740
00:27:31,919 --> 00:27:29,889
right mission to be answering them yeah

741
00:27:34,529 --> 00:27:31,929
and I'm looking forward I think to every

742
00:27:36,419 --> 00:27:34,539
single little thing I'm looking forward

743
00:27:38,009 --> 00:27:36,429
to the first lunar calibration of the EU

744
00:27:39,600 --> 00:27:38,019
the instrument there's not a lot of good

745
00:27:43,649 --> 00:27:39,610
calibration sources in the extreme

746
00:27:45,870 --> 00:27:43,659
ultraviolet but the moon reflects the

747
00:27:47,970 --> 00:27:45,880
solar spectrum very specifically in a

748
00:27:50,639 --> 00:27:47,980
way that we understand so we use it as a

749
00:27:52,200 --> 00:27:50,649
calibration source stellar calibration

750
00:27:54,360 --> 00:27:52,210
for fuv we're going to be looking at a

751
00:27:55,560 --> 00:27:54,370
star field in the ultraviolet and the

752
00:27:57,899 --> 00:27:55,570
first one of those to come through is

753
00:27:59,370 --> 00:27:57,909
going to be super-fantastic I'm also

754
00:28:01,200 --> 00:27:59,380
looking forward to the scene the first

755
00:28:04,019 --> 00:28:01,210
fringes in the interferometer for the

756
00:28:05,220 --> 00:28:04,029
for the wind instrument and I just I

757
00:28:07,470 --> 00:28:05,230
want to know exactly where I'm going to

758
00:28:09,269 --> 00:28:07,480
be I know where I'm gonna be gonna be

759
00:28:10,889 --> 00:28:09,279
standing over an engineer's shoulder

760
00:28:13,129 --> 00:28:10,899
looking at their plot when that comes

761
00:28:15,269 --> 00:28:13,139
through so everything's exciting for me

762
00:28:16,830 --> 00:28:15,279
great I think that is all the questions

763
00:28:17,430 --> 00:28:16,840

I have is there anything you guys want

764
00:28:19,259 --> 00:28:17,440
to add

765
00:28:26,789 --> 00:28:19,269
I just think Tom sounds like an

766
00:28:28,169 --> 00:28:26,799
expectant father first day of school and

767
00:28:29,850 --> 00:28:28,179
that's just how tom sounds and that's

768
00:28:31,649 --> 00:28:29,860
kind of how you feel it's like being a

769
00:28:32,730 --> 00:28:31,659
parent you know you bring them up really

770
00:28:33,870 --> 00:28:32,740
well and then you send them off into

771
00:28:36,720 --> 00:28:33,880
space and hope they behave themselves

772
00:28:38,700 --> 00:28:36,730
yeah we have competition you know we

773
00:28:40,470 --> 00:28:38,710
always talk to the gold p.i richard

774
00:28:41,460 --> 00:28:40,480
about being first you know we were

775
00:28:43,070 --> 00:28:41,470
always ahead in this

776
00:28:45,149 --> 00:28:43,080
schedule and he's on this crazy

777
00:28:47,460 --> 00:28:45,159
communications platform he's never get

778
00:28:49,289 --> 00:28:47,470
to space on the other thing he got he's

779
00:28:51,360 --> 00:28:49,299
there a year ahead of us thank God they

780
00:28:53,520 --> 00:28:51,370
did so well with that so we're finally

781
00:28:55,590 --> 00:28:53,530
looking forward to being on orbit with

782
00:28:57,360 --> 00:28:55,600
gold yeah that partnership is gonna be

783
00:28:59,250 --> 00:28:57,370
really great the in situ and the remote

784
00:29:00,779 --> 00:28:59,260
sensing working perfectly together to

785
00:29:03,360 --> 00:29:00,789
really give us the answers to the

786
00:29:05,669 --> 00:29:03,370
questions we want great well we are very

787
00:29:08,070 --> 00:29:05,679
much looking forward to all the results

788
00:29:09,690 --> 00:29:08,080

that this mission yields dr. Nikki dr.

789
00:29:12,419 --> 00:29:09,700
Thomas thank you very much for joining

790
00:29:18,330 --> 00:29:12,429
us thank you thank you go Pegasus go

791
00:29:20,159 --> 00:29:18,340
icon go icon hopefully you had a chance

792
00:29:22,560 --> 00:29:20,169
to tune in to the broadcast and see the

793
00:29:24,299 --> 00:29:22,570
launch of icon she was successfully

794
00:29:27,899 --> 00:29:24,309
delivered to space the evening of

795
00:29:29,580 --> 00:29:27,909
October 10th 2019 I'm Joshua Santora and

796
00:29:31,620 --> 00:29:29,590
that's our show thanks for stopping by

797
00:29:34,710 --> 00:29:31,630
the rocket ranch special thanks to our

798
00:29:37,140 --> 00:29:34,720
guests Phil Joyce dr. Nikki Fox and dr.

799
00:29:39,899 --> 00:29:37,150
Thomas Amell and another big thanks to

800
00:29:41,490 --> 00:29:39,909
my co-host Madison Tuttle to learn more

801
00:29:44,789 --> 00:29:41,500
about icon including mission updates

802
00:29:46,380 --> 00:29:44,799
visit nasa.gov slash icon to learn more

803
00:29:48,180 --> 00:29:46,390
about LSP our commercial launch

804
00:29:50,730 --> 00:29:48,190
providers science missions and robotic

805
00:29:52,860 --> 00:29:50,740
explorers visit nasa.gov slash launch

806
00:29:54,180 --> 00:29:52,870
services and to learn more about

807
00:29:56,990 --> 00:29:54,190
everything going on to the Kennedy Space

808
00:29:59,370 --> 00:29:57,000
Center go to nasa.gov slash kennedy

809
00:30:00,840 --> 00:29:59,380
check out nasa's other podcasts to learn

810
00:30:03,770 --> 00:30:00,850
more about what's happening at all our

811
00:30:05,940 --> 00:30:03,780
centers at nasa.gov slash podcasts a

812
00:30:08,430 --> 00:30:05,950
special shout out to our producer john

813
00:30:10,860 --> 00:30:08,440

Sackman our sound man Lora Mae 3 enter

814
00:30:13,770 --> 00:30:10,870
Mike Chambers and special thanks to Mary

815
00:30:15,930 --> 00:30:13,780
McLaughlin and Ken Appel and remember on

816
00:30:17,450 --> 00:30:15,940
the rocket ranch even the sky isn't the